WHAT IS CLAIMED IS:

1. A method for calculating a center frequency and a bandwidth for a radar doppler filter, the center frequency and bandwidth calculated to provide radar performance over varying terrain and aircraft altitude, pitch, and roll by keeping a doppler swath centered in an antenna beam, said method comprising:

receiving an antenna mounting angle, a slant range, and velocity vectors in body coordinates;

calculating a range swath doppler velocity, and a track and phase swath bandwidth using the antenna mounting angle, slant range, and velocity vectors;

calculating a phase swath doppler velocity based at least in part on the range swath doppler velocity and the track and phase swath bandwidth;

calculating a range swath center frequency based on the range swath doppler velocity;

calculating a phase swath center frequency based on the phase swath doppler velocity; and

calculating a level and verify swath bandwidth based upon the track and phase swath bandwidth.

2. A method according to Claim 1 wherein calculating a range swath doppler velocity comprises determining a doppler velocity, Vr at a range swath center frequency according to $Vr = Vv \times Cos(90\text{-}r\text{-}a) = Vv \times Sin(a + r)$, where $Vv = (Vx^2 + Vz^2)^{0.5}$, where Vx = velocity component on body x axis and Vz = velocity component on body z axis, $a = ATan(Vz / Vx)$, and r is the antenna mounting angle.

3. A method according to Claim 2 wherein calculating a range swath center frequency comprises determining a range swath center frequency, Fr, according to $Fr = 2 \times Vr / L$, where L is a wavelength of the radar.

4. A method according to Claim 3 wherein the wavelength, L, is 0.2291 feet.

5. A method according to Claim 1 wherein calculating a phase swath doppler velocity comprises calculating a phase swath doppler velocity, Vp, according to $Vp = Vv \times Cos(90-(r-p)-a) = Vv \times Sin(a + r - p)$, where $Vv = (Vx^2 + Vz^2)^{0.5}$, where Vx = velocity component on body x axis and Vz = velocity component on body z axis, $a = ATan(Vz / Vx)$, r is the antenna mounting angle, and $p = (T \times Vx / H) \times (180 / \pi)$ in degrees, where $T = 1 / \pi B$ and is a delay through range swath filter, $T \times Vx$ is vehicle movement on body X axis, B is the swath bandwidth, and H is altitude in feet.

6. A method according to Claim 5 wherein calculating a phase swath center frequency comprises determining a phase swath center frequency, Fp, according to $Fp = 2 \times Vp / L$, where L is a wavelength of the radar.

7. A method according to Claim 6 wherein the wavelength, L, is 0.2291 feet.

8. A method according to Claim 1 wherein calculating a track and phase swath bandwidth, B, comprises:

setting a filter time constant equal to a time for travel across a swath; and

calculating filter bandwidth, B, according to $B = Vx / (0.6(H)^{0.5})$ in hertz, where Vx = velocity component on body x axis and H is altitude in feet.

9. A method according to Claim 8 wherein level and verify swath bandwidth is calculated as a ratio of level and verify bandwidths to track and phase bandwidths, K, multiplied by track and phase swath bandwidth, B.

10. A processor configured to:

receive an antenna mounting angle, a slant range, and velocity vectors in body coordinates;

calculate a range swath doppler velocity, and a track and phase swath bandwidth using the antenna mounting angle, slant range, and velocity vectors;

calculate a phase swath doppler velocity based at least in part on the range swath doppler velocity and the track and phase swath bandwidth;

calculate a range swath center frequency based on the range swath doppler velocity;

calculate a phase swath center frequency based on the phase swath doppler velocity; and

calculate a level and verify swath bandwidth based upon the track and phase swath bandwidth.

11. A swath band pass filter, said filter comprising a first order filter, said filter configured to center on a doppler frequency and operate according to $Eo = (A0/B0) \times En - (A0/B0) \times En \times Z^{-2} - (B1/B0) \times Eo \times Z^{-1} - (B2/B0) \times Eo \times Z^{-2}$, where En is an input signal, A0 is $2 \times Fs \times Wb$, B0 is $(4 \times Fs^2) + (2 \times Fs \times Wb) + (Wl \times Wu)$, B1 is $(2 \times Wl \times Wu) - (8 \times Fs^2)$, and $B2 = (4 \times Fs^2) - (2 \times Fs \times Wb) + (Wl \times Wu)$, and $Wb = 2\pi B$, a bandwidth in radians, $Wu = 2\pi \times (Fc + B/2)$, an upper 3db point of said filter in radians, and $Wl = 2\pi \times (Fc - B/2)$, a lower 3db point of said filter in radians.

12. A radar signal processing circuit comprising:

a radar gate correlation circuit configured sample radar data at a sampling rate;

a correlation bass pass filter configured to filter non-zero gated radar return samples and ignore zero amplitude samples;

a mixer configured to down sample an in-phase component and a quadrature component of the filtered signal to a doppler frequency;

a band pass filter centered on the doppler frequency; and

a processor configured to determine a center frequency for said band pass filter.

13. A radar signal processing circuit according to Claim 12 wherein said band pass filter is configured to operate according to $Eo = (A0/B0) \times En - (A0/B0) \times En \times Z^{-2} - (B1/B0) \times Eo \times Z^{-1} - (B2/B0) \times Eo \times Z^{-2}$, where En is an input signal, A0 is $2 \times Fs \times Wb$, B0 is $(4 \times Fs^2) + (2 \times Fs \times Wb) + (Wl \times Wu)$, B1 is $(2 \times Wl \times Wu) - (8 \times Fs^2)$, and $B2 = (4 \times Fs^2) - (2 \times Fs \times Wb) + (Wl \times Wu)$, and $Wb = 2\pi B$, a bandwidth in radians, $Wu = 2\pi \times (Fc + B/2)$, an upper 3db point of said filter in radians, $Wl = 2\pi \times (Fc - B/2)$, a lower 3db point of said filter in radians, Fs is a sampling frequency and Fc is a determined center frequency for said band pass filter.

14. A radar signal processing circuit according to Claim 12 wherein said processor is configured to:

receive an antenna mounting angle, a slant range, and velocity vectors in body coordinates using the antenna mounting angle, slant range, and velocity vectors;

calculate a range swath doppler velocity, and a track and phase swath bandwidth;

calculate a phase swath doppler velocity based at least in part on the range swath doppler velocity and the track and phase swath bandwidth;

calculate a range swath center frequency based on the range swath doppler velocity;

calculate a phase swath center frequency based on the phase swath doppler velocity; and

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Claim 14 wherein
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Claim 15 wherein
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Claim 14 wherein
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and p = (T × Vx /
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and H is altitude

Claim 17 wherein
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Claim 14 wherein
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Claim 19 wherein
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level and verify bandwidths to track and phase bandwidths, K, multiplied by track and phase swath bandwidth, B.

21. A method for centering a doppler swath within an antenna beam, said method comprising:

controlling a swath filter center frequency based on aircraft velocity; and

controlling swath filter bandwidth based on aircraft velocity such that a charge time for the filter is equal to the time that the aircraft takes to fly across the doppler swath.

22. A method according to Claim 21 wherein an antenna mounting angle, a pitch of the aircraft, and an angle to a center of the antenna beam are known, and the swath filter center frequency, Fc, is calculated according to Fc = 2 × Velocity × sin (angle) / radar wavelength.

23. A method according to Claim 22 wherein controlling swath filter bandwidth comprises setting a bandwidth, B, according to B = Velocity / $(0.6(H)^{0.5})$ in hertz, where H is altitude in feet.